I CLAIM:

1. An apparatus for routing packets of digital data comprising:

a superconducting switch having a first input port, a plurality of output ports, and a control input, wherein the superconducting switch routes data packets from the first input port to any of the plurality of output ports, and wherein the output port to which the data packets are routed depends on a control input;

a superconducting data reader that extracts destination information from an incoming data packet at a reference time;

a controller, implemented in non-superconducting technology, that (a) chooses, based on the extracted destination information, one of the plurality of output ports and (b) sends a control signal to the control input of the superconducting switch, wherein the control signal configures the superconducting switch to route the incoming data packet to the chosen output port; and

a delay element that delays the arrival of the incoming data packet at the superconducting switch with respect to the reference time until after the superconducting switch has been configured to route the incoming data packet to the chosen output port.

2. The apparatus of claim 1, wherein the superconducting switch also has a second input port, and wherein the superconducting switch routes data packets from the second input port to any of the plurality of output ports.

3. The apparatus of claim 1, wherein the superconducting switch comprises a crossbar switch.

4. The apparatus of claim 1, wherein the superconducting switch comprises a Banyan switch.

5. The apparatus of claim 1, wherein the superconducting data reader comprises a shift register.

6. The apparatus of claim 1, wherein the controller chooses which of the plurality of output ports the incoming data packet should be routed to by using the extracted destination information as an index into a look-up table.

7. The apparatus of claim 1, wherein the destination information is transmitted from the superconducting data reader to the controller via an optical data link.

8. The apparatus of claim 7, wherein the control signal is transmitted from the controller to the superconducting switch via an optical data link.

9. The apparatus of claim 1, wherein the delay element comprises a fiber optic delay line.

10. The apparatus of claim 1, wherein the delay element comprises a superconducting circuit.

11. The apparatus of claim 1, further comprising:

an optical receiver that converts the incoming data packet from optical pulses to RSFQ pulses, and provides

the RSFQ pulses to the superconducting data reader and the delay element; and

an optical transmitter that converts RSFQ output signals from the superconducting switch's output ports to optical signals.

12. The apparatus of claim 1,

wherein the delay element comprises a fiber optic delay line, and wherein the apparatus further comprises:

a first optical receiver that converts the incoming data packet from optical pulses to RSFQ pulses, and provides the RSFQ pulses to the superconducting data reader;

a second optical receiver that converts the delayed data packet from optical pulses to RSFQ pulses, and provides the RSFQ pulses to the superconducting switch's input ports; and

an optical transmitter that converts RSFQ output signals from the superconducting switch's output ports to optical signals.

13. An apparatus for routing a data packet to a destination comprising:

superconducting circuitry having at least one input and a plurality of outputs; and

a nonsuperconducting controller,

wherein the superconducting circuitry extracts destination information from the data packet and sends the extracted destination information to the nonsuperconducting controller,

wherein the controller (a) selects, based on destination information sent from the superconducting

circuitry, one of the plurality of output ports, and (b) sends an instruction to the superconducting circuitry to route the data packet to the selected output port, and

wherein the superconducting circuitry routes the data packet to the selected output port in accordance with the instruction sent from the controller.

14. The apparatus of claim 13, wherein the superconducting circuitry comprises switching circuitry and destination extraction circuitry, and wherein the data packet's arrival at the switching circuitry is delayed with respect the data packet's arrival at the destination extraction circuitry.

15. The apparatus of claim 14, wherein a fiber optic delay line is used to delay the data packet's arrival at the switching circuitry with respect the data packet's arrival at the destination extraction circuitry.

16. The apparatus of claim 14, a superconducting circuit is used to delay the data packet's arrival at the switching circuitry with respect the data packet's arrival at the destination extraction circuitry.

17. The apparatus of claim 14, wherein the switching circuitry has a crossbar architecture.

18. The apparatus of claim 14, wherein the switching circuitry has a Banyan architecture.

19. The apparatus of claim 14, wherein the controller chooses which of the plurality of output ports the

incoming data packet should be routed to by using the extracted destination information as an index into a look-up table.

20. The apparatus of claim 14, wherein the controller selects one of the plurality of output ports by using the destination information as an index into a look-up table.

21. The apparatus of claim 14, wherein the at least one input of the superconducting circuitry is fed by at least one optical receiver, and the plurality of outputs of the superconducting circuitry is fed into a plurality of optical transmitters.

22. A method of routing a data packet through a switch having a plurality of output ports, the method comprising the steps of:

extracting destination information from the data packet;

selecting one of the plurality of output ports for the data packet by using the extracted destination information as an index into a look-up table;

generating a delayed version of the data packet using a delay element having a flow-through architecture;

providing the delayed version of the data packet to a switch; and

instructing the switch, before the delayed version of the data packet arrives at the switch, to route the delayed version of the data packet to the output port selected in the selecting step,

wherein the extracting step is performed using superconducting circuitry, and the selecting step is performed using nonsuperconducting circuitry.

23. The method of claim 22, wherein the generating step is performed using a fiber optic delay line.

24. The method of claim 22, wherein the generating step is performed using a superconducting circuit.

25. The method of claim 22, further comprising the steps of converting incoming data from optical signals to RSFQ signals, and converting outgoing data from RSFQ signals to optical signals.